CLAIMS

What is claimed is:

2. Apparatus for fiber length measurements from a tapered beard attached to a fiber sampler, comprising:

a rectangular channel into which a tapered beard is drawn by a gas flow through said channel, said channel having two opposed major sides corresponding to channel width and length, and two opposed minor sides corresponding to channel height and length;

one of said major sides comprising a transparent window;

an optical imaging device viewing the tapered beard through said transparent window for acquiring a two-dimensional image of the tapered beard; and

a digital computer connected to an output of said optical imaging device for storing two-dimensional image data and determining fiber amount as a function of one-dimensional distance x from the fiber sampler by averaging across the width of the tapered beard as imaged.

3. The apparatus of claim 2, wherein said optical imaging device comprises a scanner intended for scanning documents.

4. The apparatus of claim 3, wherein said scanner is a color scanner.

5. The apparatus of claim 3, wherein said scanner includes an illumination source.

6. The apparatus of claim 2, wherein said optical imaging device comprises a digital camera.

7. The apparatus of claim 2, wherein said rectangular channel has a height of approximately 2 mm, a width of approximately 100 mm, and a length of approximately 50 mm.

8. The apparatus of claim 7, wherein gas flows through said channel at a rate of approximately 0.25 m^3/sec.

9. Apparatus for fiber length measurements from a tapered beard attached to a fiber sampler, comprising a scanner intended for scanning documents positioned with reference to the tapered beard for acquiring a two-dimensional image of the tapered beard.

10. The apparatus of claim 9, which further comprises a digital computer connected to an output of said scanner for storing two-dimensional image data and determining fiber amount as a function of one-dimensional distance x from the fiber sampler by averaging across the width of the tapered beard as imaged.

11. A method for image-based length measurement comprising:

acquiring a two-dimensional digital image of a tapered beard of fibers, the beard having a length;

employing a computer to analyze the digital image to determine fiber amount as a function of one-dimensional distance along the length of the tapered beard by averaging across the width of the tapered beard as imaged;

analyzing the determined fiber amount as a function of distance to produce a fiber length distribution; and

outputting the fiber length distribution.

12. A method for calibration of length measurement systems providing probability density functions (PDFs) for tapered beards, comprising:

forming a tapered beard subsample from a bulk sample of at least one sample of known, monolength staple fibers, the fibers of the bulk sample having diameter and surface properties similar to those of a subsequent sample under test having unknown length distributions;

measuring the uncalibrated amount versus distance reponse for each such monolength group;

developing correction functions from each such monolength sample to provide calibrated amount versus distance for said monolength fibers;

storing said calibration functions and interpolations therof in a computer memory;

forming a tapered beard subsample of unknown length fibers and measuring the uncalibrated amount versus distance response;

correcting the uncalibrated amount versus distance response for said unknown tapered beard to produce a calibrated amount versus distance response;

determining the second derivative of said calibrated amount versus distance response for said unknown tapered beards;

normalizing and filtering the second derivative to produce a calibrated PDF for the unknown subsample; and

calculating from said calibrated PDF any length data products desired.

13. The method of claim 12, wherein the desired statistics are UHM, ML, LUI, 2.5% span, or SFC.

14. The method of claim 12 wherein the amount versus length response is from an image-based system.

15. The method of claim 12 wherein the amount versus length response is from an air flow based system.

16. The method of claim 12 wherein the amount versus length response is from an optical extinction based system.

17. The apparatus of claim 2, wherein said optical imaging device provides spectrally-resolved data, and fiber amount as a function of one-dimensional distance x is determined based on data for a particular color.

18. The apparatus of claim 10, wherein said scanner provides spectrally-resolved data, and fiber amount as a function of one-dimensional distance x is determined based on data for a particular color.

19. The method of claim 11, which comprises acquiring spectrally-resolved image data, and employing the computer to determine fiber amount as a function of one-dimensional distance based on data for a particular color.